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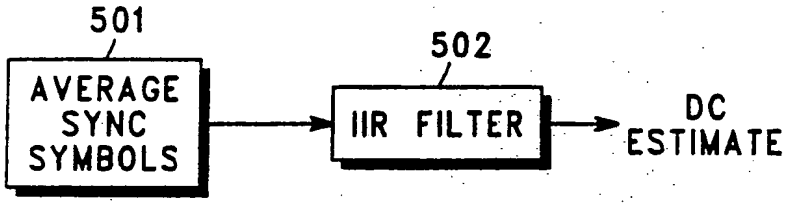
(54) Title: METHOD OF DC OFFSET COMPENSATION USING A TRANSMITTED DC COMPENSATION SIGNAL



(57) Abstract

A DC offset compensation method that makes use of a received DC compensation signal (107) having a known average value, such as zero. Differences between the known average value and the actually received average value are utilized to calculate a DC compensation value suitable for use in compensating subsequently received data information.

* See back of page

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METHOD OF DC OFFSET COMPENSATION USING A TRANSMITTED DC COMPENSATION SIGNAL

Technical Field

This invention relates generally to DC offset compensation of received data signals.

Background of the Invention

Transmission of data signals through various mediums is known in the art (as used herein, "data" refers to binary or multilevel signalling, as versus analog signal waveforms). When receiving such a signal, it is not uncommon for a varying DC component to become combined therewith and possibly distort data recovery.

To compensate for this, various DC offset compensation methodologies have been proposed. Although at least some of these prior art approaches can be implemented in a digital signal processor (DSP), such implementations require a relatively significant portion of the processing capacity of the DSP. This, in turn, increases current drain requirements for the DSP and/or limits availability of the DSP for support of other desired functions.

Accordingly, a need exists for a method of DC offset compensation that will substantially reliably compensate for DC offset in a received data signal, and that may be implemented, if desired, in a DSP without over burdening the processing capacity of the DSP.

Brief Description of the Drawings

Fig. 1 comprises a timing diagram of a communication resource format implemented in accordance with the invention;

Fig. 2 comprises a depiction of a sync word waveform in accordance with the invention;

Fig. 3 comprises a block diagram of a receiver constructed in accordance with the invention;

Fig. 4 comprises a depiction of a received sync word; and

Fig. 5 comprises a block diagram depiction of a part of the DSP operation when programmed in accordance with the invention.

Best Mode For Carrying Out The Invention

For purposes of this description, an embodiment of the invention will be described in conjunction with a time division multiplexed (TDM) communication resource. In this particular example, the frequency is subdivided into time frames, wherein each time frame is further subdivided into four time slots (101) (Fig. 1). In a given time frame, two of the time slots (102) are used for the transmission of binary signalling information relevant to the allocation of the voice time slots (103) and other system control information.

Each control slot (102) in turn includes space for four commands (104), a slot designation (106), and a sync word (107).

In this embodiment, the sync word (107) is comprised of the hex word zero nine D seven (09D7) (see Fig. 2). In binary form, as represented in Fig. 2, this equates with the sequential transmission of: 0000100111010111. Since this particular sync word, when represented in binary form, includes eight zeroes and eight ones, the average value of the sync word equals zero.

In this embodiment, it will be presumed that the constituent elements of the sync word will be transmitted in a predetermined order, as set forth above, with each broadcast. In a particular application, however, such a requirement may not be necessary. Also, in this particular embodiment, the average value of the sync word elements equals zero, and the importance of this will be made more clear below. (Other elements could perhaps be used in an appropriate application, wherein the average value would not equal zero. What would be important in such an application, however, is that both the average value of the constituent elements of the sync word be predetermined and known to the receiver, and that the system gain also be known to the receiver, since this gain would scale the non-zero average value.)

A receiver (300) (Fig. 3) suitable for practicing the method of the invention will now be described. This receiver (300) includes an antenna (301) for receiving the signalling information (302) transmitted to it, including the data sync words (107). These signals (302)

are processed in an appropriate RF unit (303) and reduced to baseband. An analog to digital convertor (304) then digitizes this representation, and provides the digitized representation to a DSP (306) (such as a 56000 family device as manufactured and sold by Motorola, Inc.) where the signal can be demodulated and processed as desired. Voice transmissions received and processed in this way can then be reconverted to analog form by a digital to analog convertor (307), and the resulting audio signal (308) can be further processed and amplified as appropriate to the particular application.

The receiver (300) further includes a processing unit (309) to control the operation of the RF unit (303) and of the DSP (306). In addition, the processing unit (309) can receive and process recovered signalling information from the DSP (306). Also, an appropriate clock (311) provides necessary clock signals to the DSP (306) and processing unit (309), as may be appropriate to the particular application.

So configured, signals (302) received by the receiver can be processed in various programmable ways in the DSP (306). Such configurations, of course, are known in the art. In this particular embodiment, however, the DSP (306) processes samples (401) of the received sync word (107) (see Fig. 4) at various times. The anticipated time of arrival of the sync word (107), and the constituent elements and order thereof, are of course known to the receiver (300). Therefore, by comparing an average of the sampled values with the value that the receiver (300) would expect to find, the DSP (306) can calculate the difference. These differences can then be used to calculate a DC

compensation value suitable for use with subsequently received data.

In particular, the offset values calculated for this sync word, and also for previously received sync words, can effectively be averaged over time (501 and 502) (see Fig. 5) in the DSP to provide an estimated DC compensation value. As indicated earlier, this DC compensation value can then be used by the DSP to compensate for DC offset in subsequently received data information.

So configured, the DSP (306) is spared the necessity of constantly monitoring the received signal in support of an ongoing DC offset compensation calculation. Instead, by providing for reception of a sync word that effectively also operates as a DC compensation signal, having a substantially known average value, the DSP need only occasionally calculate a substantially reliable DC compensation value that can be used for DC compensation purposes.

What is claimed is:

Claims

1. A method of DC compensating a received signal, characterized by the steps of:

A) receiving a DC compensation signal having a substantially known average value;

B) calculating a DC compensation value using the DC compensation signal.

2. The method of claim 1 wherein the known average value is approximately zero.

3. The method of claim 1 wherein the DC compensation signal comprises a data packet.

4. The method of claim 3 wherein the data packet includes a binary representation of 0, 9, D, and 7.

5. The method of claim 4 wherein the binary representations of 0, 9, D, and 7 are organized in a predetermined manner.

6. The method of claim 3 wherein the known average value of the data packet is zero.

7. The method of claim 1 and further characterized by the steps of:

A) receiving subsequent non-DC compensation signals;

B) using the DC compensation value to DC compensate the non-DC compensation signals.

8. The method of claim 7 wherein the known average value is approximately zero.

9. The method of claim 7 wherein the DC compensation signal comprises a data packet.

10. The method of claim 9 wherein the data packet includes a binary representation of 0, 9, D, and 7.

11. The method of claim 10 wherein the binary representations of 0, 9, D, and 7 are organized in a predetermined manner.

12. The method of claim 9 wherein the known average value of the data packet is zero.

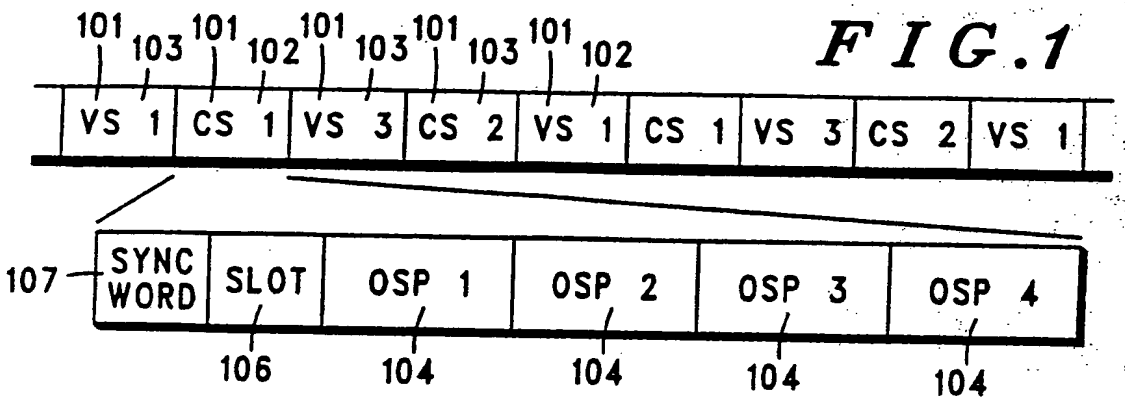


FIG. 1

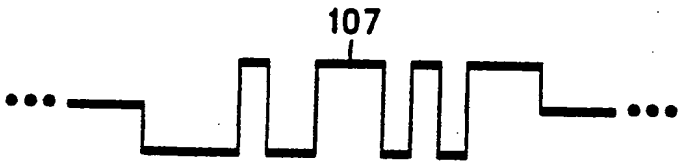


FIG. 2

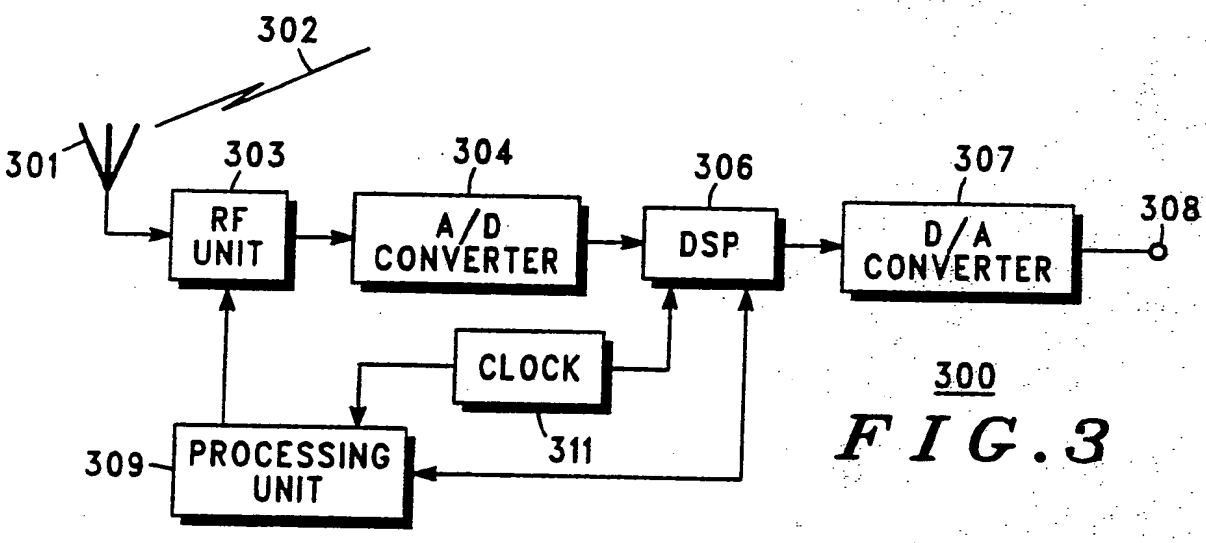
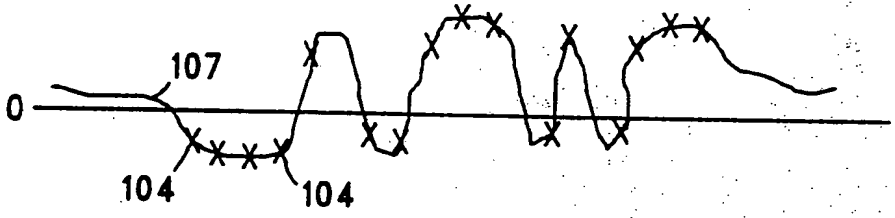


FIG. 3

FIG. 4



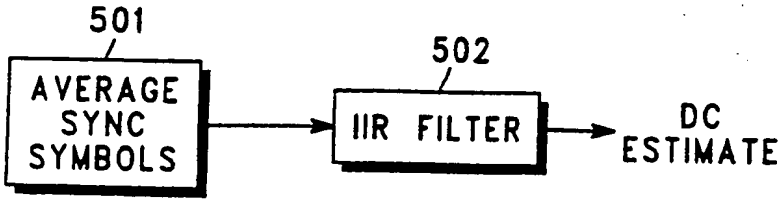


FIG. 5

INTERNATIONAL SEARCH REPORT

International Application No PCT/US90/05358

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC (5) : H04L 25/06,25/10
U.S. Cl : 375/36

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
U.S.	375/19; 358/171; 307/491; 328/168,173; 330/11

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [6]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category *	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
X / Y P	US,A 4,873,702 (CHIU) 10 October 1989 See the Abstract and Figure 2.	1 & 7 / 2-6 & 8-12
Y	US,A 4,387,364 (SHIROTA) 07 June 1983 See Figures 4-7.	2-6 & 8-12

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IV. CERTIFICATION

Date of the Actual Completion of the International Search [2]	Date of Mailing of this International Search Report [2]
06 DECEMBER 1990	31 JAN 1991
International Searching Authority [1]	**Signature of Authorized Officer [20]**
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